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ABSTRACT

Policy analysis consists of evaluating policy options in terms of their effects. The analysis is not complete, however, until the reasoning has been reversed, starting at the outcome end and reasoning back to the first choice (backward mapping). Reversing the logic has two effects on analysis; it provides insurance against unanticipated effects, and it changes the content of the policy options recommended. Using reversible logic also means deliberately building into one's parochial (narrow) solution an anticipation of others' parochial solutions. An energy consumption example can be used to demonstrate how reversible logic works. The forward leg starts with a standard set of implements, the backward leg with a set of decisions that policy would have to affect in order to influence energy consumption. The forward and backward legs produce almost opposite results. Youth employment is a complex example of a multiple-jurisdiction, multiple-outcome policy. Employment policy may have several purposes. Successful implementation consists of trading multiple objectives against one another to achieve desired outcomes. Other sources of complexity are multiple political jurisdictions and variations in the parameters that influence policy. (YLB)

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# FORWARD AND BACKWARD MAPPING:

# REVERSIBLE LOGIC IN THE ANALYSIS OF PUBLIC POLICY

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**Forward and Backward Mapping:**

**Reversible Logic in the Analysis of Public Policy**

"Cheshire Puss," Alice began, rather timidly,. . . "Would you tell me, please, which way I go from here?"

"That depends a good deal on where you want to get to," said the Cat.

"I don't much care where. . ." said Alice.

"Then it doesn't matter which way you walk," said the Cat.

". . .so long as I get <u>somewhere</u>," Alice added as an explanation.

"Oh you're sure to do that," said the Cat, "if only you walk long enough."

--Lewis Carroll, <u>Alice in Wonderland</u>

* * *

If I were planning a trip by automobile from Seattle to Boston, I could choose a route in at least a two ways. One way would be to start in Seattle and trace a path east on I-90, the major interstate highway. I could follow that highway on my map until I reached a point where it became clear that I would miss my destination if I stayed on the highway. Then I could adjust my route north or south to arrive in Boston. Another way would be to start in Boston, look at the alternative routes heading west, choose the route that seemed most closely to approximate the rough latitude of Seattle, follow it west, and as I approached Seattle, adjust it north or south. In fact, if I were interested in finding the most efficient route, the most scenic route, or the one that would take me closest to my sister in Denver, I would probably use both techniques.

* * *

Decision trees are a commonly-used technique for analyzing sequential decisions affected by chance. To construct a decision tree, we first break a complex problem into a series of choices (decision nodes) and uncertain events (chance nodes). We then arrange those choices and events in sequence from the first possible choice to all possible outcomes or end values. The branches of the decision tree describe alternative paths to a variety of end values. In this form a decision tree is a useful descriptive model, but it is utterly useless as a normative model-- that is, as a model for deciding which path to take. To use a decision tree for this purpose, we must assign values to the pay-offs associated with each node on each path. We do this by "folding-back" or "flipping" the tree. Folding-back or flipping involves using the values at the ends of various branches to assign values to specific nodes along each path. The model works, first, by laying out sequences of choices and events, and then by using end results to assign values along each path.[1]

* * *

Physicists and astronomers are currently converging on a theory of the origin of the universe. The theory began in the 1920s with the discovery by astronomers that other bodies in our galaxy are receding from us. This discovery led to the "big bang" theory, which hypothesizes that the universe had its origins in a single large explosion of enormously dense matter some 10 to 20 billion years ago. In search of a way to test this theory, physicists have hit upon an ingenious idea. If the big bang did occur, they reason, the universe must have been an undifferentiated mass just prior to the event. But research on sub-atomic particles shows a variety of elementary particles and forces. The process of getting from an undifferentiated state to a differentiated one, they reason, must of have consisted of a kind of "cooling out." At the earliest stages of this process, elementary particles and forces, as we know them, did not exist because the energy produced by the concentration of matter was so extraordinarily high that they could not form or operate. As the concentration of matter decreased, elementary particles collided to form more complex combinations, held together by more diverse forces. One can reconstruct the formation of the universe, in other words, by examining the energy necessary to break apart or combine sub-atomic particles. And one can infer the behavior of sub-atomic particles by examining the behavior of the universe.[2]

Alice's problem was that she didn't know either where she was or where she wanted to go. In the three examples that follow Alice's problem, it is clear that even if you know where you are and where you want to go the process of getting there is often more complex than it seems. The examples all share the same logic, a logic so commonplace that we often don't recognize it, much less exploit it. The logic is essentially this: To get from a starting point (Seattle, the first choice in a decision tree, sub-atomic particles) to a result (Boston, the best outcome, a theory of the universe), we don't just set an objective and go there. We begin at either end and reason both ways, back and forth, until we discover a satisfactory connection. In some instances, decision trees, for example, this logic is explicit and orderly; in others, my cross-country driving, for example, it is intuitive and disorderly. In both cases, it is "reversible."[3] That is, we can't get from a starting point to a result until the logic works both ways, forward and backward. If I were to leave Seattle, heading east, intending to end up in Boston, I might never get there, because it happens that the interstate highway from Seattle doesn't go there. But if I mentally plan my trip by starting in <u>both</u> Boston and Seattle, searching for a satisfactory connection between them, my chances of getting from Seattle to Boston are markedly improved, though by no means certain. For analytic purposes, it doesn't matter whether I start in Boston or Seattle, so long as I do both at some point and make sure that the route I choose from either end connects somewhere in the middle.

<u>Policy Analysis and Reversible Logic</u>

Policy analysis, whether practiced by academics, professional analysts, or policymakers, consists essentially of specifying alternatives, values, and outcomes for policy decisions. The utility of analysis lies not so much in thinking of proposals that no one has thought of before, but of disaggregating

choices into their constituent parts and assessing one alternative against another. The main rationale for policy analysis is that decisionmakers, hence the public, are better served if their judgements are informed by a thoughtful evaluation of alternatives.

This view of policy analysis contains a number of questionable assumptions, many of which we will examine in due course. For the moment, let's focus on the notion that analysis consists of evaluating policy options in terms of their expected effects. Say, for example, we were interested in finding ways to reduce energy consumption. The range of tools, or implements, available to policymakers might include (1) a purely voluntary program designed to demonstrate the costs of certain kinds of energy consumption and the benefits of reduced consumption; (2) a program based on graduated utility rates designed to increase the unit costs of energy as consumption increases; and (3) a program of mandatory building code regulations designed to force property owners to make changes that reduce energy consumption. These implements could be treated as alternatives by themselves or they could be combined in various ways to frame alternatives. The value of policy analysis lies in its ability to specify what each implement consists of, what it might cost, and what its likely effect on energy consumption would be. Once this specification is done, a policymaker could make an informed choice.

The alert reader will see a flaw in this logic. What exactly is this policymaker choosing? He or she is choosing a hypothetical cause-and-effect relationship between an implement, or a bundle of implements, and an expected effect. If the specification is carried to the point of saying, for example, that "graduated rate schedule 'x' can be expected to produce energy savings 'y,'" we have established a hypothetical relationship between rates and consumption. What we have <u>not</u> done is to reverse the logic and assess the cause-and-effect relationship from the point of view of the energy consumers

or the implementing agencies, asking what options they face. We would find, if we did this, that the population of consumers is heterogeneous. Some will repond rationally by making capital investments in energy conservation up to the point where the marginal returns in reduced consumption equal marginal costs of modernization. Some will be unable to respond rationally for lack of access to capital, and will simply pay a premium for energy. Some will disconnect their utility meters. And some will organize a coalition of energy consumers to modify the rate schedule.[4] These responses to energy conservation policy will present certain problems to the implementing agencies. They will produce an aggregate effect on energy consumption that may or may not be consistent with the effect that policymakers expected when they chose the graduated rate schedule. If the actual effects were consistent with policymakers' expectations, it might not matter in the short run whether our analysis had accounted for the possible responses consumers and implementing agencies. But the effects of policies are seldom exactly what we expect them to be. When the effects are not consistent with our expectations, we are in deep trouble if we haven't accurately portrayed possible responses to the policy, because we have no systematic way of knowing what went wrong.

Specifying alternatives and assessing their expected effects is only part of the analytic problem, in other words. It is like the first stage of constructing a decision tree, where decisions, chance events, and expected outcomes are arrayed in a logical sequence. The analysis is not complete until we have reversed the reasoning, starting at the outcome end and reasoning back to the first choice. Reversing the logic has two effects on our analysis. First, it provides insurance against unanticipated effects, so

that if things start to go wrong in the implementation process we have an intelligent response. But second, and more importantly, it changes the content of the policy options we recommend.

Policy analysts use terms like "iterative"[5] to describe this process of reasoning back and forth between first choices and expected effects. Regardless of what you call it, reversible logic carries an important message for both analysts and policymakers: Specifying the expected relationship between implements and their effects is only half the analytic process-- the forward mapping half, if you will. The other half consists starting with the choices confronting people at the "outcome" end and playing the consequences of those choices back through the sequence of decisions to first choices-- the backward mapping half, if you will.

Policy Content and Reversible Logic

When I presented the first version[6] of this argument about reversible logic, in the form of a plea for backward mapping, friendly critics responded in at least two ways. One group made what might be called the "codified common sense" response. They would say (usually with a slightly defensive edge to their voice), "That's exactly how I think about problems..., been doing it for years..., nothing very original there." Another response was "nice idea, but no practical utility." "It makes a certain amount of sense," these critics would say sympathetically, "but you could never get a state legislator to think that way."[7] Leaving aside the question of whether the idea is original (I went to some pains to explain not only that it wasn't original but that I had stolen it outright from Mark Moore), these two responses are revealing. One response says essentially that the idea is so commonplace it is hardly worth belaboring, the other says it's so novel ordinary people would never use it. Both responses have an element of truth,

and therein lies the analytic utility of reversible logic. It is useful precisely because it captures a common pattern of thought. But it also raises problems of feasibility, since regardless of how common the pattern of thought, it is not used systematically either by policymakers or policy analysts.

Faced with a problem, policymakers frame solutions using implements over which they exercise the greatest control.[8] Actors at different political and administrative levels control different implements. Each set of implements has a limited range of effectiveness. The content of policy at any given level of the system is a function of the implements people control at that level and the effects they are trying to produce at other levels. The outcomes of policy are a function of how well implements at different levels mesh together to produce a result.

At any given political or administrative level, people have strong incentives to view the success of policy mainly, or entirely, in terms of the implements they control, disregarding the fact that the overall success of the policy depends not on their implements alone but on the relationship between their implements and those at other levels. The result of these incentives is that people at different levels tend to focus on "parochial" solutions--solutions that are narrow in their effects and limited by the incentives that operate at that level. There is no guarantee that this interlocking system of parochial solutions will produce a result that anyone would regard as a "success." Nor is there a universal principle ordaining that any result which emerges from this system of interlocking solutions is a "good" result. The system, in fact, produces many failures.

Reversible logic provides an explicit way to anticipate the effect of parochial solutions on the outcomes of policy. People at different political and administrative levels may or may not recognize that they operate in a

system of interlocking parochial solutions. Their long-term success depends, to a large degree, however, on their ability to anticipate the actions and responses of people at other levels. This strategic sense is relatively rare, even though it is in everyone's self-interest to have it. This explains why reversible logic is both extraordinary and commonplace. When we see someone operating with a relatively sophisticated command of reversible logic, we think of that person as extraordinary. But the notion that people should learn to adjust their actions to the expected actions of others is so embarrassingly simple it seems trivial.

We would expect reversible logic, the more it is used, to increase the likelihood that a policy will "succeed," from the standpoint of both parochial and external criteria. In mundane terms, using reversible logic means deliberately building into one's parochial solution an anticipation of others' parochial solutions.

Seen in these terms, policymaking and implementation are specialized forms of bargaining; policy analysis is the formulation of bargaining strategies. The characteristic features of bargaining are that (1) no actor controls sufficient resources to determine another's actions with certainty; (2) the interests of the actors are not identical, so that conflict over ends and means is, to some degree, inevitable; (3) the actors have something of value to gain from staying engaged with each other, so that to some degree, they depend on each other; hence, (4) solutions to bargaining problems require "the formation of mutually consistent expectations" among people with a stake in the outcome.[9] A good bargaining strategy provides a way of maximizing one's own interests, but it also provides a way of anticipating the actions of others.

A policy is both an authoritative statement of what should happen and a calculated judgement about what will happen. Like any bargaining strategy, policies must have sufficient flexiblity to allow for the difference between what should and what will happen. Policymakers make strategic errors when they confuse their aspirations about what should happen with their calculated judgements about what will happen. Policy analysis works best when it puts calculated judgements in the service of aspirations. The more careful the calculations that precede the construction of a policy (up to the point, of course, where the calculations begin to interfere with the likelihood of getting something done), the more likely it is that policymakers will anticipate the responses of other actors and factor them into the content of the policy. The more likely it is, in other words, that they will explicitly use reversible logic.

Energy Conservation: A "Simple" Example

To demonstrate how reversible logic works, let's return to the energy conservation example. Energy conservation is a relatively simple case, first, because it can be handled as a problem of relationships among levels within a single governmental jurisdiction, and second, because it has a relatively clear outcome, that is, reduced consumption or a reduced rate of increase in consumption.

Assume that a municipally-owned utility delivers energy to all consumers in a city. The city also has a Building Department, one function of which is to enforce the city's building code. The City Council makes policy for all city departments, including rates for the utility and modifications in the building code. The energy conservation issue comes before the Council when the Utility proposes to invest in new electrical generating capacity to meet a projected increase in energy demand. Members of the Council reply that,

before the City invests in new generating capacity, it should attempt to reduce consumption through energy conservation measures. The Council, and its analytic staff, undertake a review of options for reducing or controlling energy consumption.

Table 1A shows a set of implements and their corresponding streams of action. The problem confronting the Council and its staff is how to construct a policy, composed of one or more implements, that reduces energy consumption or, at least, slows its rate of growth.

Reading Table 1A from left to right we see a common policy analysis problem: a choice of voluntary, incentive-based, and regulatory implements. The effects of these implements depend on a number of parameters.[10] The voluntary approach depends mainly on consumers' preferences for energy relative to other goods, captured in part by the relative price of energy. If we expect information on how to conserve energy to affect energy consumption, then we must assume that present demand for energy is not an accurate reflection of consumer preferences-- that is, people would voluntarily consume less energy and more of something else if they understood how to conserve. The incentive-based approach consists of a "gradient," in which the unit price of energy rises as consumption increases. It might also contain exceptions for particular classes of individuals or firms. Its effect on consumption depends on the price elasticity of demand for energy. Changes in the rate structure will affect energy consumption to the degree that consumption is sensitive to changes in price and to the degree that the gradient or slope of the rate structure introduces incentives to conserve. The regulatory approach is based on building code requirements that are designed to reduce energy consumption. These requirements might be applied to new structures only, or to all structures that undergo changes significant enough to require a building permit. This approach also requires a decision, explicit or

**TABLE 1A:**

**Forward Mapping: Energy Conservation**

| Implements | Parameters | Implementing Agencies | Targets | Outcomes |
|---|---|---|---|---|
| What implements does the Council have to affect energy conservation? | What external factors influence these implements? | What agencies are responsible and what actions required? | To whom is the implement addressed? | . . . with what expected effect? |
| **Voluntary Approach**<br>>Information | >Relative Price of Energy | Agency:<br>>None. Options:<br>>new agency<br>>Bldg. Dept.<br>>Utility<br>Action:<br>>Inform consumers of conservation measures | >All energy consumers | >Information allows consumers to act on preferences; results in reduced consumption |
| **Incentive-Based Approach**<br>>Rate Structure<br>>"gradient"<br>>coverage:<br>exceptions? | >Price Elasticity of Demand | Agency:<br>>Utility<br>Action:<br>>Bills consumers | >All energy consumers | >Price increases as consumption increases: direct economic incentive to conserve |
| **Regulatory Approach**<br>>Building Code<br>>coverage:<br>new construction, renovation?<br>>inspection/ construction ratio | >Rate of Construction/Renovation<br>>Marginal Cost of Compliance | Agency:<br>>Bldg. Dept.<br>Action:<br>>Inspects, enforces | >Building permit applicants | >Code requires conservation measures; inspection and enforcement lead to compliance; compliance leads to conservation |

implicit, on how much inspection is necessary for each unit of new construction in order to enforce the code. The effect of the regulatory approach depends on the rate at which new construction occurs and the marginal cost of compliance with code provisions. Building code regulation will reduce energy consumption, in other words, if buildings are renovated or constructed at a rate sufficient to affect the aggregate demand for energy, if the Building Department can enforce the requirements reliably, and if the marginal cost of compliance with the energy conservation requirements is at least equal to the returns in reduced energy consumption.

Evaluating these options as mutually exclusive alternatives, based on a quick assessment of their features and the parameters affecting their performance, we get something like the following results: The voluntary approach is likely to produce the lowest pay-off in reduced consumption of the three options, since it contains no incentives to conserve other than free information. It has a higher likelihood of being implemented than the regulatory approach but a lower likelihood than the incentive-based approach. The voluntary approach can be implemented by disseminating information, while the regulatory approach requires inspection and enforcement. But the incentive-based approach reaches energy consumers more directly than the voluntary approach, through the rate structure, rather than depending upon consumers to use information. The incentive-based approach is likely to produce the highest returns in reduced consumption as well as having the highest probability of being implemented. The regulatory approach probably produces a greater reduction in consumption than the voluntary approach but less than the incentive-based approach, with the lowest likelihood of being

implemented. The exact order of the options depends, of course, on the composition of the policies and the values of the parameters. But we can get a rough sense of the stakes from this quick analysis.

If we were choosing among these options, as mutually exclusive alternatives, based strictly on this analysis, we would probably choose the incentive-based approach. There are uncertainties about the price elasticity of demand and the correct slope for the rate structure, but these uncertainties are a good deal less than those confronted in either the voluntary or the regulatory approaches. Furthermore, the incentive-based approach appears to maximize the degree of control the City Council exercises over rates and consumption. Rather than deferring to the tastes of individual consumers, or to the regulatory skill of the Building Department and the vicissitudes of the real estate market, the Council can directly alter the choices of consumers by manipulating the price of energy.

Up to this point, we've done a relatively conventional analysis of policy alternatives, with perhaps a bit more attention to estimates of implementation than is usually the case. The analysis has a kind of appealing common-sense logic. Saying that the best way to get consumers to conserve energy is to give them a financial incentive to do so is a lot like saying that the shortest distance between two points is a straight line.

Now let's reverse the logic, turning to Table 1B. Instead of starting with policy alternatives, specifying the parameters that effect their performance, and predicting their effects, let's examine energy consumption from the point of view of consumers and producers.

Taking consumers as a point of departure, the first thing that's evident is that they are not a homogeneous group. There are large industrial consumers, for whom the decision to conserve initially means either reduced

TABLE 1B:

Backward Mapping: Energy Conservation

| Targets | Outcomes | Parameters | Implementing Agencies | Implements |
|---|---|---|---|---|
| What decisions have the most immediate effect on energy consumption | What outcomes would the Council want to follow from these decisions? | What external conditions influence these outcomes? | What must implementing agencies do to promote conservation and minimize its effects on their internal operations? | What implements are available to the Council to affect energy consumption? |
| **Real Estate Developers** | | | | |
| >New Construction | >Purchasers demand lower energy costs; operating costs reflect energy savings | >Cost of new construction technology | **Utility:** >Capital investment, replacement increase efficiency of energy production | >Restrict total capacity; authorize capital investments that increase efficiency within that limit |
| >Renovation | >Operating costs of existing bldgs. reflect energy savings; return on investment increases | >Condition of existing stock; rate of replacement; cost of financing | >Load management responds to effects of conservation | >Returns from sales of excess energy earmarked to increase productive efficiency of to reduce rates |
| **Industrial Consumers** | | | | |
| >Location Decisions | >Existing production remains; operating costs reflect energy savings | >Relative cost of energy as a factor production | **Building Department:** >New regulatory requirements minimize displacement of existing functions | >Require disclosure of easily-measured energy performance features: insulation, windows, walls, etc. |
| >Capital Investment | >New investments in plant, technology; energy savings increase return on investment | >Cost of new production technology; cost of financing | **New Agency[?]:** >Focus information on investment, production, consumption decisions with high economic return to consumers | >Provide evaluations of returns from reduced consumption on new production, construction technology |
| **Residential Consumers** | | | | |
| >New Housing Construction | >Purchasers demand lower energy costs | >Cost of new construction technology; cost of financing | | |
| >Renovation | >Operating costs of existing housing reflect energy savings | >Condition of existing stock; cost of financing | | |
| >Consumption | >Household consumption decreases without change in living standard | >Cost of reduced consumption | | |

owners and developers, for whom conservation initially means increased construction and renovation costs; and there are residential consumers, for whom conservation initially means increased prices for new housing, increased costs for renovation, and decreased consumption, with its attendent effects on living standards. Each type of consumer has somewhat different stakes in energy conservation; their behavior in response to any policy will be a function of how they perceive those stakes. Furthermore, energy conservation policies set up choices for consumers. Different consumers face different choices. And their individual choices have collective consequences that are important to policymakers.

From the consumers' point of view, the decision to conserve is based on the price of energy relative to other consumption goods or factors of production, the costs associated with conservation, and the likelihood of future returns on conservation. As the price of energy rises, the decision of whether to conserve becomes more apparent to consumers. But there are any number of reasons why they might not choose to conserve. They might not have access to the technology necessary to conserve, the cost of capital may sufficiently high to raise doubts about the long-run returns on energy conservation, they might not believe that the price of energy will continue to rise, they might pass the increased costs of energy on to someone else, or they might alter consumption patterns and factors of production so that they consume the same amount of energy but less of something else.

In order for energy conservation policy to work it must exert a marginal influence on a myriad of consumption and production decisions. If we view the policy from the consumer's perspective, we must ask what policy implements would cause consumers to "tip" their decisions, on the margin, in favor of conservation. In order to answer this question, we have to think in terms of

the value of consumption and conservation to various types of consumers and the ways in which policy can affect consumption decisions. Taking this perspective, gives us somewhat different results than we got by looking at the problem from the perspective of the Council. We see immediately that if we can't influence certain key decisions (new construction, renovation, location, capital investment, etc.), we cannot expect energy conservation policy to have an effect. But we can also see that there might be incentives to conserve independent of any new energy conservation measures the Council might undertake. If, for example, purchasers of new commercial buildings and residences were to calculate energy costs in determining the real price of the structure, then they would probably demand lower energy costs. This, in turn, would mean that builders would compete, not just on sales price, but also on long-run energy costs-- just as automobile manufacturers compete on gasoline mileage. If commercial real estate owners and industrial firms were to calculate the return on their investment that could be captured from reduced operating costs due to energy conservation, then they might be willing to invest in conservation. If household consumers could see how reduced energy consumption could result in the same or a better living standards, then they might be willing to alter their consumption behavior. All these conditional propositions depend, of course, on the present and future prices of energy, relative to other goods and factors of production, and on the availability of information about the future consequences of present decisions. The Council can, to some degree, control these implements.

Based on this analysis, the role of information appears to be more powerful than it was when we took the "forward mapping" perspective; but it is only powerful, we have learned, when it can be targeted on key consumption and investment decisions. General information about the value of conservation is not likely to have much effect; specific information targeted on specific

consumers facing specific decisions may have a much larger effect.

We can also see from this analysis that the presumed advantages of the the incentive-based system may not be what they seem. If there is an incentive built into the existing rate structure for conservation, why might the Council want to adopt a graduated rate structure? Industrial consumers face production, capital investment, and plant location decisions, in which the cost of energy is major factor. Large industrial consumers pay city taxes. The proportion of their business they choose to locate in the city is their decision, not the City Council's. The graduated rate structure might have the perverse effect of reducing total energy consumption by reducing the number of industrial consumers, hence the city's tax base. The same argument applies to commerical real estate developers.

Building code regulations also look different from the consumers' end. The effect of building code regulations, from this perspective, is to impose a mandatory increase in building construction and renovation costs, without regard for future returns on reduced consumption. If the regulations are based on accurate assumptions about the price of energy, consumer preferences, and returns on investment in conservation, then they will result in reduced consumption exactly equal to that which would have been produced without regulation. But these returns will be offset by the costs of enforcement and inspection. If the regulations are based on inaccurate assumptions about price, preferences, and returns on investment, then they will result either in too much conservation or the same amount of conservation that would occur without regulation (again offset by inspection and enforcement costs). Too much conservation means essentially that the marginal costs of conservation exceed the returns gained from increased efficiency.

This doesn't mean that regulation has no potential role in the Council's

energy conservation strategy. There will always be uncertainties about the rate of return on building technologies that result in conservation. There will likewise always be unscrupulous developers who will attempt to exploit consumers' lack of awareness of energy costs as a factor of the real price of housing by building shoddy housing or doing shoddy renovations. Taking the energy consumer's perspective, however, suggests that regulation, if it is to be effective, can't be the sole implement of conservation policy, since it carries a high risk of perverse effects. The role of regulation, it seems, is to set "threshold conditions," below which building standards should not fall, but to avoid imposing costs that have no future returns.

Now let's look at energy conservation from the perspective of implementing agencies. The Utility, recall, initiated the discussion of energy conservation by requesting permission to seek financing for more generating capacity. The Council responded by suggesting conservation as an alternative to new capacity. The utility and the Council clearly have different views on the matter of energy consumption.

The Utility is a major public enterprise. Its performance is evaluated by how well it meets demand for energy, and at what price. Its ability to meet these performance expectations depends, in turn, on how well it maintains and replaces its capital stock. From the Utility's point of view, requests for additional generating capacity are not just pleas for more energy, they are major capital investment decisions. These decisions are made by balancing the revenues produced by the existing rate structure against current operating expenses and future plans for replacing or updating generating and distribution facilities. A proposal to substitute conservation for capital investment presents the Utility with a major management problem. If the overall effect of conservation is to reduce consumption, holding rates constant, as might happen with the voluntary or regulatory approaches, then

the Utility faces lower revenues. If the effect of conservation is to reduce overall consumption, but to increase rates for certain levels of consumption, as might happen with the incentive-based proposal, then the Utility might face stable or increased revenues. Either way, conservation introduces uncertainties into the Utility's revenue-expenditure calculations. We would expect it to respond to any conservation policy by trying to minimize these uncertainties.

Furthermore, reduced energy consumption presents certain logistical, or "load management," problems for the Utility. Utilities typically meet their demand and price expectations by supplying energy from a number of different sources. A single utility might meet its demand for electrical energy by juggling nuclear, fossil fuel, and hydroelectric sources, as well as by contracting with other utilities to buy and sell energy. Determining the right mix of energy sources, at any given level of demand, is a tricky management problem. The problem is even trickier when demand shifts-- as it would if conservation were working. It might involve reallocating demand among energy sources, renegotiating contracts with sellers of energy, or attempting to sell excess capacity to other utilities.

None of these problems is insurmountable, but taken together they suggest that the Utility will respond to energy conservation policies by attempting to minimize their effect on capital investment and load management. These responses must be anticipated in any conservation policy the Council formulates.

A smart Council member, no matter how committed he or she is to energy conservation as an alternative to capital investment, would want to examine the consequences of reduced demand for the internal operations of the utility. Failing to do so could mean that conservation might be labeled "unsuccessful,"

even if it wasn't. Suppose, for example, that energy conservation, by the graduated rate method, creates a surplus of energy, which the Utility then sells at a handsome "profit" to a neighboring utility. Large industrial consumers, now paying higher rates, inquire during the Utility's next rate hearing before the Council why these "profits" have not been passed on to rate-payers in the form of lower rates. The answer, from the Utility and from pro-conservation Council members, would have to be, "because we're promoting conservation, not lower utility rates." Is this where you would like to be if you were a pro-conservation Council member? Probably not. What would happen if the Utility were forced to take a loss on its sale of surplus power?

Or suppose the utility is engaged in a long-term capital investment program, gradually phasing out inefficient fossil fuel generating plants and substituting more efficient energy sources. One effect of reduced demand projections, the utility argues after the conservation plan has gone into effect, has been to slow down the rate of capital replacement, effectively depriving rate-payers of the benefits of more efficient generating plants. How would you reply to this if you were a pro-conservation Council member?

The point is not that the Utility, or its large industrial clients, will inevitably oppose energy conservation or try to sabotage it, though they might. The point is rather that conservation policies create certain internal management problems for the Utility, given the incentive structure within which it works. If a Council member is really interested in conservation as a policy objective, these difficulties will have to be anticipated, or the chances of a successful conservation policy will be severely reduced. Among the implements that the Council could use to address the Utility's capital investment problem is to limit total capacity temporarily, but to authorize capital investments that would increase the efficiency of production within that limit. This would give the Utility an incentive to focus its capital

investment decisions on projects that promote conservation and that have direct returns to consumers, rather than on those that simply augment capacity on the assumption that increased capacity creates its own demand. The Council might address the issue of "profits" from the sale of excess energy by stipulating that the proceeds from these sales be used either for investments that increase efficiency within existing capacity, or for reduced rates to consumers.

Now consider the Building Department. The Department, unlike the utility, is a regulatory agency. Its performance is evaluated by how well it enforces structural and zoning requirements. Its ability to meet these performance expectations is predicated, in large part, on how well it allocates inspectors to building sites, and how effective those inspectors are at spotting potential violations. An important characteristic of such agencies is that they control their workload by "rationing" services.[11] They respond to "cases" which are generated by external forces and frequently the supply of cases exceeds the resources necessary to manage them.[12] When this happens, front-line managers confront important discretionary choices. Do they allow bottlenecks and queues to develop, do they speed up their processing of cases (with reduced inspection time), or do they ask for additional resources? The actual effect of enforcement, then, depends heavily on how front-line managers and inspectors respond to new demands and variations in workload.

For the Building Department, an energy conservation code simply means an increase in workload. If it comes with additional resources, it means hiring new inspectors as well as training existing inspectors and front-line managers in the requirements of the new code. If it does not come with additional resources, it means adding new functions to existing workloads, training

inspectors and front-line managers in how to handle the additional work. In any event, changes in the building code present inspectors and front-line managers with a more complex array of activities to perform and, hence, with additional discretionary choices.

A smart Council member, then, would want to have a clear picture, before the fact, of how the Building Department would allocate its new enforcement responsibilities under the conservation code, what effect these responsibilities would have on existing workloads, and how future workloads could be expected to change as a function of both the new policy and the real estate market. Failing to ask these questions might mean that the code could subsequently turn out to be unenforceable. The point is not that the building department is inherently resistant to energy conservation, though it may be. The point is rather that conservation is one of many functions that have to be integrated into a common inspection and enforcement system. The incentive structure of the Building Department emphasizes the orderly handling of cases. One option available to the department, confronted with a new charge, is simply to produce the same orderly flow of cases at a lower level of actual inspection and enforcement. This response could well defeat the purpose of the conservation code.

If the conservation code increases costs to consumers, without regard for returns from conservation, and if it creates additional administrative workload, without necessarily producing a proportional increase in conservation, then it seems that regulation is a relatively limited implement for accomplishing the Council's purposes. The main utility of regulation would seem to lie in establishing certain minimum conditions which prevent real estate developers and builders from misrepresenting the energy costs of new structures. This function has less to do with building code requirements than with information, since one can require that certain performance

charateristics of structures be accurately reported without necessarily requiring that buildings be designed according to certain standards. In other words, the "regulatory" problem for the Council is more a problem of information than one of setting building standards.

Notice, in Table 1A, that the voluntary alternative has no implementing agency attached to it. This presents a common implementation problem--where to put a function when no existing agency has a presumptive claim to it. The options facing the Council are to create an entirely new agency or to give the function to an existing agency, like the Utility or the Building Department, that has complementary functions. The approach one would use to address this problem is an extension of predicting how an existing organizationa will respond to changes in policy. We would want to know how the information function would fit into the incentive structure of whatever organization we were considering, we would want to examine the policy in terms of competing or complementary functions within the organization, and we would want to anticipate implementation failures that might result from conflicts with the incentive structure and existing functions. In the utility, how compatible would a voluntary program be with the organization's dominant function, the production and distribution of energy? In the building department, how compatible would the program be with the inspection and enforcement function? If we were to create a new agency to administer the program, how much influence would we expect that agency to have on the consumption of energy if it were isolated from the production-distribution or inspection-enforcement functions?

The importance of these questions only really becomes apparent when we take the backward mapping view. Information, when it is highly targeted, is potentially more effective than it appeared to be in the forward mapping view because we can see its effect as a "tipping" device in the consumption, production, and investment decisions of energy consumers. But the question of where to locate the information function administratively is fairly subtle. It requires some specification of what we mean by "information" and "targeting." If by information we mean technical data on building and production technology, and economic analyses of their effects on energy consumption, then it is highly unlikely that a city agency would be a producer of such information. It might, however, be a disseminator of the information if it existed already and could be assembled in a form that was useful to commercial consumers. If by targeting we mean affecting specific capital investment decisions, then the process of using information has to be initiated by the consumer, since there is no way an administrative agency can track day-to-day investment decisions by firms. These definitions of information and targeting would seem to point to a modest technical assistance activity, underwritten by the City and focused on a few conspicuous cases, to demonstrate the returns from adopting certain energy-saving technologies of broad applicability. The rationale for public involvement is not to subsidize the technology itself, since the returns on conservation accrue mainly to private firms and individuals, but to subsidize information in order to create a short-term competitive advantage for a few firms that can in turn be used to tip other firms into energy-saving investments. Since the Utility has no direct incentive to encourage conservation, it would seem sensible to locate this function in a small free-standing organization, staffed by people with technical and economic expertise sufficient to evaluate the effects of energy-saving technology. The performance of such an organization could be evaluated

directly by its ability to sell commercial clients on more efficient ways to use energy.

Information can also mean data on the energy costs of new residences and on energy savings to owners of existing residences from renovation and changes in consumption. In this instance, targeting means affecting the purchasing decisions of new-home buyers by providing estimates of energy costs and affecting renovation and consumption decisions by providing estimates of energy savings from specific changes. Neither the Building Department nor the Utility has a strong incentive to encourage conservation by these means. But it is possible to think of ways to attach energy conservation information to the purchase and building permit processes, without adding signficantly to the costs of inspection and enforcement. Where there are standardized measures of energy efficiency, as for example in the performance characteristics of insulation, multi-paned windows, and heating systems, this information can be easily conveyed to prospective buyers of new residences and to applicants for building permits to renovate existing residences. Builders could be required to report dwelling characteristics that affect energy consumption as part of the permit process, and this information could be routinely made available to prospective purchasers. Applicants for permits to renovate existing residences could be given information on energy savings attributable to specific changes in dwellings. These tasks would seem to be quite compatible with the incentive structure of the Building Department. Neither of these measures could be expected to have a strong short-term effect on energy consumption, since energy costs are one of many attributes that people consider in purchasing or renovating a home. The rationale for this type of intervention is the same as that for subsidizing information to private firms-- to tip the decisions of residential consumers in the direction of

energy conservation by providing home builders with an incentive to compete on energy efficiency and individuals with an incentive to include energy consumption in the calculation of costs of renovation.

Reversible Logic: Reprise

We've now done both the forward and backward legs of the energy conservation analysis. Recall that the value of reversible logic is not just that it helps us anticipate implementation problems, but more importantly that it affects the way we frame and evaluate alternatives. On the forward leg, we started with a standard set of implements; we then asked what external conditions would affect those implements, how implementing agencies would be expected to respond to the implements, to whom the implements were addressed, with what expected effect. On the backward leg, we started with a set of decisions that policy would have to affect in order to influence energy consumption; we then asked what outcomes would have to follow from those decisions in order to sustain a policy of energy conservation, what external conditions would affect those decisions, how implementing agencies would have to adapt to conservation, and finally what implements the Council could use to affect the decisions of consumers and implementors.

On the forward leg, the incentive-based alternative seemed both more likely to be implemented and more likely to produce the desired effects than the regulatory alternative; either the incentive-based or regulatory alternatives seemed more likely to be effective than the voluntary alternative. On the backward leg we got almost the opposite result. Information seemed a more powerful device, and one more likely to produce the desired effect, when we looked at conservation from the standpoint of key decisions affecting energy consumption.

Giving consumers a direct economic incentive to conserve through graduated rates turns out to be just as problematical, in its own way, as regulation. Regulations create problems for conservation because they set uniform standards, without regard for the economic returns from conservation; under the best of circumstances, they codify what energy consumers would do anyway if they were acting consistently with their own interests; under the worst circumstances, they levy economic penalties by requiring investment in conservation in excess of that which produces economic returns to consumers. Graduated rates, on the other hand, create disincentives for consumption above a certain level, even if the consumer is efficient, and they overlook the incentives for conservation that are built into any rate structure. In addition, neither the regulatory nor the incentive-based approaches accounts for the administrative uncertainties that conservation imposes on the the Utility and Building Department.

What we learned on the backward leg was that energy conservation, in the aggregate, is composed of a myriad of decisions, taken by different types of consumers. These decisions are affected by the availability of new construction and production technology, the relative cost of energy as a factor of production, the rate of replacement, and the condition of existing housing stock, among other external factors. Policy works on the margin of energy consumption decisions, by "tipping" them in the direction of conservation. Information, if it is the right kind and if it is targeted on the right decisions, can be a more effective tipping mechanism than regulation or economic penalties for consumption, because it increases returns to consumers. Hence, targeted information on how to capture the economic returns from energy conservation is an important implement in any conservation strategy.

Does this analysis mean that the Council should choose information over regulation and economic incentives? Not exactly. What it suggests is that the Council, if it decides to pursue the regulatory or incentive-based approaches, should do so with the knowledge that these approaches contain perverse incentives that could defeat the purpose of conservation. The analysis also suggests that these approaches can be designed to anticipate perverse incentives.

There are at least two ways to anticipate perverse incentives. One is to modify the implements themselves. We found, for example, that regulation could play an effective role in energy conservation if it focused more on disclosure of energy consumption characteristics of buildings and less on specifying the attributes of the buildings themselves. We also found that any implement had to anticipate the effects of conservation on administrative agencies-- capital investment and load management in the Utility; workload and discretionary enforcement in the Building Department. In other words, we can increase the likelihood that <u>any</u> implement will work better by adapating it to what we know about the choices confronting individuals and organizations when they respond to that implement.

Another way to anticipate perverse incentives is to "hedge." Instead of viewing regulation, incentives, and information as mutually exclusive alternatives, one can think of combinations of these implements, each compensating for weaknesses in the others. Some variant of the graduated rate scheme might, for example, result in decreased consumption, while at the same time resulting in increased or stable revenues for the Utility. The danger of this approach, from the point of view of the Council, is that it contains disincentives for firms to locate energy-intensive production in the city. A sensible response to this problem would be to focus information on those firms with the highest likelihood of relocating, demonstrating how

they could reduce consumption to compensate for the effects of increased rates. In others words, information can be used to anticipate the defects of graduated rates.

Whether the Council chooses to pursue an energy conservation policy, and what form that policy will take if they do, is not necessarily a function of what formal analysis tells them is the "correct" solution. If we were able to abstract the energy conservation decision from the Council's political environment, then we could posit a correct decision, based largely on normative economic theory. That solution might involve recommending no energy conservation measures at all. But we can't abstract the decision from its political environment. So the analytic problem is not so much recommending the "correct" solution as it is providing the Council with as sensible an assessment as possible of the stakes in choosing various implements to accomplish conservation. This assessment requires that analysts understand not only the formal characteristics of various implements, but also how individuals and organizations will respond to those implements.

The Council's problem, in a nutshell, is that it can only affect energy consumption by manipulating utility rates, building code requirements, and information. These implements are not sufficient, by themselves, to produce the effect the Council would like. In this sense, these implements are parochial solutions to the energy conservation problem. In order to affect energy consumption, they have to be linked with administrative implements-- capital stock, energy supply, and load management, for the Utility; inspection and enforcement, for the Building Department-- and they have to tip certain choices by energy consumers in the right direction. The success of energy conservation policy depends on how skillfully the Council can create a structure of incentives and controls that, on balance, reduces or limits

consumption. Constructing a policy, then, is like constructing a bargaining strategy. It involves a series of calculated judgements about how organizations and individuals will respond to the choices presented to them by a policy.

Youth Employment: A Complex Example[13]

The energy conservation example was "simple" because it involved a single jurisdiction and it was designed to produce a single outcome. Most public policy problems are not so simple. They involve relationships among multiple jurisdictions and they are designed to produce multiple outcomes. Multiple jurisidictions and multiple outcomes increase the complexity of implementation problems substantially. One task of analysis is finding ways to make this complexity more manageable.

Employment is a good example of a multiple-jurisdiction, multiple-outcome policy. All levels of government have a stake in employment, but no single level can affect employment without some assistance from the others. Each level controls something the others need. Policies initiated at the national level are elaborated and administered at the state and local level. Local labor markets have a substantial effect on national policies. Policies initiated by states and localities are constrained by those established at the national level. Economic policies set at the national level limit the effect of state and local policies.

Employment policy has many purposes, only one of which is to assure that people find jobs. Some policies-- child labor laws, for example-- are intended to restrict access to the labor market for certain classes of people in order to protect them or to reduce competition with other classes of people. Other policies-- regulation of wages, hours, and working conditions, for example-- are designed to affect the treatment of people who are already employed, rather than to make employment available to those who are not. Some

policies-- unemployment insurance and income support, for example-- are designed to soften the effects of unemployment. Other policies— labor exchanges and public employment, for example-- are explicitly designed to assure that people find jobs. Still others-- vocational education, for example-- are designed to prepare people for work but those who deliver these services are not themselves directly responsible for assuring that recipients get jobs.

Finally, employment policies have different target groups. They address the "cyclically" unemployed, or those temporarily out of work because of adverse economic conditions; the "structurally" unemployed, or those chronically out of work for lack of education and experience; and the "frictionally" unemployed, or those having difficulty either entering the labor market or moving from one skill level to another for lack of access to training and experience.

Taken together, these features-- multiple jurisdictions, multiple implements, multiple objectives, and multiple target groups-- make employment policy difficult to analyze. These features are also shared by a broad class of policies, making employment a good example for illustrating the utility of reversible logic with complex policies.

For purposes of this example, let's focus on federal policies addressed to the employment problems of young people, aged 16 to 24. As Table 2a shows, the main implements the federal government has to deal with youth employment are (1) grants to states and localities, used to finance education, training, work experience, and public employment; (2) regulation of wages, hours, and working conditions, designed to limit the type and amount of work young people can do; and (3) incentives for private employers, in the form of wage subsidies or tax credits, designed to provide subsidized private employment.

These implements are targeted in variety of ways. Some grants carry conditions limiting participation to low-income youth and prescribing the type of activities for which funds can be used; others carry only limits on the type of activity. Employer incentives carry income conditions and limits on duration of subsidized employment. Regulations typically apply uniformly to all young people in a given age interval, with exceptions based on the size of the employer and the type of industry.

The major features of youth employment policy are readily apparent from a cursory reading of Table 2a. The feature that is most apparent is that the purpose of federal policy cannot be described solely as reducing unemployment among young people, although that would be a tempting simplification. To be sure, a large amount of employment occurs as a result of federal policy, and it is likely that the rate of unemployment among young people would be higher if it weren't for federal policy. But it is also true that the largest determinants of youth unemployment are the mix of jobs in the economy and the overall rate of unemployment, not federal policy. When there is an abundance of jobs at relatively low skill levels and the supply of labor is tight relatively to demand, youth unemployment will be relatively low, regardless of what federal policy does. In addition, many federal policies are designed not so much to reduce unemployment as to limit the conditions under which young people are employed, redistribute employment opportunities, and increase the quality of labor force entrants. Wage, hour, and working condition regulations, for example, set limits on youth employment in the interests of protecting young people from exploitation and protecting adult workers from displacement. These policies may actually increase unemployment among young people. Income-conditioned grants and incentives don't necessarily reduce unemployment when the supply of labor is abundant relative to demand, but they may make low-income youth more competitive for the limited number of jobs that

**TABLE 2A:**

**Forward Mapping: Youth Employment**

| Implements | Parameters | Implementing Agencies | Targets | Outcomes |
|---|---|---|---|---|
| What implements does the federal govt. control to affect youth employment? | What external factors influence these implements? | What public and private organizations implement policies directed at youth employment? | To whom are the implements addressed? | . . .with what expected effect? |
| **Conditional Grants**<br>>Type of activity: education, vocational training, work experience, public employment<br><br>>Population: targeted by age, income | | **Education/Training:**<br>>Elementary, secondary schools provide education in basic skills (locally-funded, locally-administered)<br>>Vocational programs provide specialized skills (federal, state, local funding; locally administered)<br>>Employment training system provides basic skills, work experience, specialized skills, public employment for low-income population (federally-funded, locally administered by separate jurisdiction from education) | >Basic skills untargeted<br><br>>Vocational training untargeted<br><br>>Employment training targeted by income, age | >Basic education provides skills needed for specialized training<br><br>>Grants for vocational training produce entry skills; young people compete for jobs<br><br>>Employment training provides remedial services for low-income population |
| **Regulations**<br>>Minimum wage<br>>Hours, working conditions<br>>Population: targeted by age, covered occupations | >Labor force participation rate; preference for school, work<br><br>>Structure of local labor markets; availability of low-wage, low-experience jobs | **Wages, Hours, Working Conditions:**<br>>State employment security inspects, enforces (federally-mandated, state-enforced) | >Enforcement targeted by covered occupation | >Enforcement limits entry, set lower limits on wages, restricts hours; limits displacement of adult workers |
| **Employer Incentives**<br>>Direct subsidies: reduced wages for on-the-job training<br>>Tax credits: reduced taxes for employing targeted workers<br>>Population: targeted by age, income, duration of subsidy | >Structure of local education, training institutions; availability of entry-level skill training<br><br>>Structure of income support, unemployment benefits | **Employer Subsidies:**<br>>Employment training system administers wage subsidies for on-the-job training (federally-funded, locally-administered)<br>>Employment security/income security certify employees' elibility for tax credit subsidy (federally-funded, state-administered) | >Wage subsidies targeted by income<br><br>>Tax credits targeted by income, age | >Employers train workers, hire them full-time after subsidy expires<br><br>>Employers hire subsidized workers; workers gain experience; employers hire them after subsidy expires |

exist. Grants that are conditioned only on the type of activity, and not the income of the participants, don't necessarily reduce unemployment or redistribute opportunities, but they do raise the quality of labor force entrants.

Unlike the energy conservation example, where we could be relatively confident that the policy we were analyzing was designed to reduce or control energy consumption, we cannot say with the same assurance that the purpose of federal policy toward youth employment is to reduce unemployment. In fact, federal youth employment policy has several purposes: reducing unemployment, limiting employment conditions, redistributing opportunities, and increasing the quality of entrants to the labor force. These objectives are more and less difficult to achieve, depending on labor market conditions. They often contradict each other, again depending on labor market conditions. It is easy to say that, because these objectives are sensitive to external conditions and often contradictory in their effects, the policies themselves don't make sense. Having concluded that the policies don't make sense, it is equally easy to say that we should not expect them to be well-implemented.

Such an analysis misses the significance of multiple policy objectives. Taken by themselves, all the objectives of federal youth employment policy are plausible. They can all be "implemented," in the sense that single implement can be manifested in decisions and organization. But success in implementation cannot be judged simply in terms of how well each objective is achieved. To do so would produce results that no one would regard as acceptable. If the overall supply of labor were abundant relative to demand, for example, then increasing young peoples' access to employment without increasing the supply of jobs would mean forcing adults out of the labor market. No reasonable person would regard that as a "success," even if it

resulted in lower youth unemployment. But if we could contrive a way to decrease youth unemployment by holding young people out of the labor force, or by expanding the supply of jobs, then we might regard the policy as successful. The point is that successful implementation consists of trading multiple objectives against one another to achieve desired outcomes. The fact that the objectives often contradict each other is, by itself, unimportant; what's important is whether the aggregate effect of policies addressed to different objectives is in accord with what policymakers are trying to achieve at any given time.

"Trading" objectives, one against the other, is done both politically and administratively. For example, when market conditions shift, leaving the overall supply of labor abundant relative to demand, policymakers might deliberately choose to protect the adult labor market by de-emphasizing programs designed to provide immediate access to private jobs for young people and emphasizing programs designed to hold young people out of the labor force (regulation, vocational education, public jobs). They might willingly accept the risk of higher short-term youth unemployment in the interest of limiting the impact of new entrants on the adult labor market. If labor market conditions shift the other way, they might choose the opposite strategy. In both instances, policymakers are emphasizing some objectives and deemphasizing others in the interests of producing an aggregate effect.

Trading is also done administratively through the use of discretion in the allocation of resources to activities. Federal administrators, for example, might choose to emphasize or de-emphasize enforcement of wage, hour, and working condition regulations, depending on how seriously they perceive the problem of youth displacement of adult workers. Or they might focus additional administrative attention on programs designed to hold young people in school during periods of relatively high unemployment. State and local

administrators, facing unfavorable labor market conditions, might focus more attention on programs designed to slow down the rate of entry by young people into the labor market. In these instances, administrators are using their authority, within existing policies directed at multiple objectives, to achieve outcomes consistent with their perception of existing labor market conditions.

The question is not whether trading occurs among multiple policy objectives, but how skillfully it is done, with what kind of calculation, and with what aggregate effect. If policymakers and administrators misjudge changes in the parameters that affect policy or fail to understand how certain implements work, trading among objectives creates confusion and failure. This presents an important role for policy analysts. A collection of policies directed at a complex problem is like a stock portfolio. It is a set of implements, the relative value of which rises or falls in response to changing external conditions. Just as the management of a stock portfolio consists of adjusting the contents of the portfolio to maximize return, the management of multiple-objective policies consists of adjusting the relative value of different policy implements to produce an aggregate effect. If we were required to make employment policy from scratch in response to every shift in the labor market, for example, the result would be chaos. The entire range of labor market policy objectives would be open to renegotiation every time the economy changed. What policymakers do instead is to allow policies to accumulate around a problem over time, and then make marginal adjustments in those policies in response to shifts in the environment. Sometimes shifts in the environment require more than marginal changes, and substantial pieces of the portfolio are opened up for reexamination. Most of the time, adjustment occurs by adapting existing implements. Policy analysts can play a role in

this process, first, by focusing policymakers' attention on the whole portfolio, rather than on individual implements, and second, by anticipating the aggregate effects of changes in the relative importance of implements.

This role for analysis is especially important in light of the strong political and administrative incentives working against treating policies as portfolios and in favor of focusing on individual implements. Federal policymakers and administrators are inclined, for example, to define the purpose of grants to states and localities for vocational education, training, and work experience as the production of employment for young people, without regard for other policies or labor market conditions. These programs are administered by two separate systems-- the public education system and the employment and training system-- which are structurally distinct from the federal to the state and local levels. They are evaluated mainly on the basis of how many young people they place in jobs. Whether suitable jobs are available in local labor markets, whether young people are displacing low-wage adult workers, or whether vocational training is actually what young people need before they enter the labor market are questions left for others to grapple with. Incentives to private employers are administered as part of the income support and employment security system, a separate structure from the one that administers training and education. This policy is evaluated mainly on the basis of how many young people take unsubsidized employment after the tax credit or wage subsidy expires. Whether young people are filling jobs that unemployed adults could hold, whether employers are providing real training in return for the subsidy, and whether a young person's failure to take unsubsidized employment simply means that he or she has made a rational choice to search for other employment are questions left for others to answer. The regulation of wages, hours, and working conditions is administered by yet another system-- the employment security system-- which is a federally-

mandated activity that is administered by state agencies. These policies are evaluated mainly on the basis of how well employers comply. Whether the minimum wage structure inhibits or encourages employers to hire and train young workers, whether limits on hours and working conditions adversely affect access to promising jobs, or whether existing regulations actually protect young workers from exploitation by employers are questions left for others to answer. In other words, the structural separation of policies and administrative systems creates strong incentives to overlook aggregate effects. A useful role for policy analysis is to knit the pieces back together and call attention to their separate effects on aggregate results.

The forward leg of the analysis, represented in Table 2a, then, looks not just at implements, parameters, and implementing organizations, but also at the range of objectives and outcomes represented by separate policies. The effect of this kind of analysis is to direct policymakers' attention beyond the question of how well separate pieces of the system are working and toward the question of whether the aggregate effect of the whole portfolio is in line with their expectations.

Trading among multiple policy objectives to achieve aggregate effects is more than just an analytic problem, however. It is fundamentally a political process. Policy adjusts to changes in the environment and to variations among regions through the exercise of political and administrative control. At any given level of government, elected officials and administrators adapt to changes in the environment by emphasizing some implements and objectives and deemphasizing others. In employment policy, for example, different political jurisdictions are characterized by different unemployment rates, labor force characteristics, industrial bases, and labor market structures. Every implement of national employment policy relies, to one degree or another, on

lower-level political jurisidictions to "adjust" national policy to local conditions. This adjustment is more than a rational adaptation of policy to different regional or local conditions. It is a deliberate engagement of the political incentives of lower-level jurisdictions in the service of national objectives. So, again in the language of employment policy, the federal government is not simply contracting with states and localities for administrative services when it delegates authority to administer education, training, regulation, and private incentives. It is also making policymakers and administrators at the state and local level, in part, responsible for trading among objectives and producing outcomes.

On the forward leg of the analysis we treated states and localities essentially as administrative extensions of the federal government. This was a convenient way of specifying the connections between implements, parameters, implementing agencies, and outcomes. It is exactly what we did in the energy conservation example when we initially treated the utility and the building department as if their sole function were to implement energy conservation. This view of implementation is a useful analytic device, but it should not be confused with an accurate portrayal of how implementation actually occurs. It represents, at best, only half the process of implementing policy. The other half consists of the adaptive reponses of implementing agencies and lower-level jurisdictions to changes in policy. In the case of multiple-objective, multiple-jurisdiction policies these adaptations are much more complex than they are in single-objective, single-jurisdiction policies.

In the single-objective, single-jurisdiction case, we approached the backward leg of the analysis by focusing first on specific decisions that could be the targets of policy, and then playing out the consequences of these decisions for implementing agencies and policymakers. In the multiple-jurisdiction, multiple-objective case, we are presented with at least two

additional sources of complexity. First, implementing organizations are nested within political jurisdictions, so we're not just analyzing how organizations might respond; we are also analyzing how political jurisdictions will respond. Second, the parameters that influence policy differ from one jurisdiction to another. So we would expect responses to vary from one jurisdiction to another.

In the youth employment case, then, we must account not only for how young people, school systems, employment training organizations, regulatory agencies, and employers will respond to policies initiated from the federal level. We must also account for how state and local governments will affect the responses of these implementing organizations. Furthermore, we must take account of variations among states and localities in the parameters that influence policy: unemployment, labor force characteristics, industrial mix, and labor market structure.

As in the energy conservation case, turning the problem around forces a more detailed specification of precisely who youth employment policy is intended to reach, and with what effect. One group might be labeled the "high risk" population, or young people distinguished by high unemployment and low participation in education and training. For this group, choices are limited; their limited involvement in both education and work means that they enter the labor market with limited skills and experience relative to other people their age. Another group might be labeled the "transitional" population, or young people distinguished by a high rate of joint participation in school and work, a high rate of job turnover, and a gradual stabilizing of labor market participation with increasing age. For this group, choices are abundant, but they are likely to make those choices in a serial fashion, moving from one job to another, and from one education or training program to another, taking

TABLE 2B:

Backward Mapping: Youth Employment

| Targets | Outcomes | Parameters | Implementing Agencies | Implements |
|---|---|---|---|---|
| What decisions have the most immediate effect on youth employment? | What outcomes would federal policymakers like to follow from those decisions? | What external conditions influence those outcomes? | What must implementing agencies do to affect those outcomes? | What implements are available to federal policymakers to affect youth employment? |
| **High Risk Youth** (low-income, low school attainment, declining labor force participation) | | | | |
| >Education, training | >Opportunity costs of education, training equal to those for low-risk population | >Family income, income support policies | Education/Training: >Decrease incentives for labor force participation for high risk and transitional population | >Require increased access for high-risk group to vocational programs >Increase academic requirements at secondary level |
| >Labor force participation | >Entry with basic and specialized skills adequate for stable employment | >Structure of local labor market | Employment Training: >Decrease incentives for high risk population to to substitute low-wage low-skill work for investment in basic skills, specialized training | >Condition work experience, employer subsidies, public employment on academic progress |
| **Transitional Population** (all income groups, average school attainment, high labor force participation) | | | | |
| >Education, training | >Preference for schooling greater than for discretionary income from work | >Prevailing wages for low-skill jobs | Employment Security/Income Support: >Decrease the opportunity costs of education, training for low-income families | >Subsidize academic, vocational education with compensation for foregone income |
| >Labor force participation | >Entry reduced in younger years, increased with acquisition of specialized skills | >Structure of local labor markets | | |
| **Low Risk Population** (predominantly middle, upper income, low labor force particiaption) | | | | |
| >Education, training | >Preference for schooling stable | >Prevailing wages for low-skill jobs | | |
| >Labor force participation | >Entry patterns stable | >Structure of local labor markets | | |

frequent spells of voluntary unemployment, until they find a stable career. A final group might be called the "low risk" population, or young people for whom school is their main activity up to the point where they enter the labor market with a skill that provides them a relatively stable career path. This group has most of the choices available to the transitional population but doesn't exercise them, moving instead from schooling as a primary activity to work as a primary activity.

Labor market data suggest that the high risk population accounts for a relatively small proportion of youth unemployment,[14] while the largest proportion is accounted for by the transitional population. Furthermore, labor force participation has been rising consistently over the past two decades for all portions of the youth population, except minority males, for whom labor force participation has declined significantly.[15] These trends mean, in effect, that the transitional population has become the predominant group, the low risk population has declined in size, and the high risk population, while it has not increased dramatically in size, has become increasingly male and minority.

Seeing the problem in this way suggests that youth employment and unemployment mean significantly different things for different populations. The high risk group comes substantially from minority, low income families. For this group, the income foregone by participating in education and training is a significant fraction of family income, the returns from young peoples' work are likely to be a substantial fraction of family income, and hence, the costs of both education and unemployment among young family members are likely to be high. At the same time, the long-run returns from participation in education and training for this population are likely to be significant, both for the individuals themselves (in increased income) and for society at large (in decreased dependency). These conflicting incentives help to explain why

unemployment is such a serious problem for this population. The immediate returns from work are a strong incentive both to enter the labor market and to underinvest in education and training. Hence, participation in the labor force means high unemployment, weak attachment to school, and a gradual "cooling out" of expectations that results in a decline in labor force participation for some. Unemployment, or non-participation in the labor force, become chronic. But because the high risk population constitutes a relatively small fraction of the total youth population, reducing unemployment for this group does not significantly decrease the overall youth unemployment rate.[16]

The transitional group comes from all income levels, but it is largely made up of young people for whom work is a matter of preference rather than economic necessity. For the largest portion of this group, the income foregone by participating in education and training is a relatively small fraction of family income; the returns from young peoples' work significantly increase their discretionary income, but constitute a relatively small share of family income; hence, the costs of both education and unemployment are likely to be low. For the transitional group, labor force participation is explained less by family income and more by the relative value of school and work, as perceived by the young person at any given point in time. Schooling is partly a consumption good, valued for its immediate appeal relative to the income from work, and partly a longer-term investment in human capital. Hence, unemployment is likely to be much more affected by the perceived short-run and long-run value of education and training. Young people in the transitional group are much more likely to take themselves out of the labor market, or to reduce the amount of time they spend working, if they perceive education to be valuable in producing future income. The costs to them and

their families, in foregone income, are lower than for the high risk group. Because the transitional population constitutes a relatively large share of the total youth population, reducing unemployment for this group is likely to significantly decrease the overall youth unemployment rate. Unemployment can be reduced in this group by increasing the proportion of young people who prefer schooling to work, by increasing the proportion of labor market participants who are employed, or both.

Increasing the proportion of young people who prefer schooling to work means, essentially, increasing the low risk population. For the low risk population, the income foregone by participating in education and training is perceived to be small relative to the immediate and long run value of education and training. This might be true regardless of family income, but the proportional burden of foregone income is higher for low income families than for middle and upper income families. In order for young people to withdraw altogether from the labor force and pursue education and training exclusively, the value of education and training-- both as consumption goods and as investments in human capital-- must be perceived to be high. Part of the shift in the youth population from the low risk group to the transitional group can be explained by a decline in the perceived value of education and training.

Seen from the perspective of young people, the stakes of youth employment policy are different than they were from the perspective of policymakers. Work, in itself, is not necessarily the solution to the problems of the high risk population; reducing the opportunity costs of education and training appears to be a more plausible solution. This can be done by increasing family income, by increasing the short-run value of schooling, or by providing opportunities for joint pursuit of school and work. By the same token, unemployment in the transitional population is not necessarily a serious

problem, if it results in greater incentives for young people to shift their preferences from work to schooling and if schooling has a long-term pay-off. In order to affect the preferences of the transitional population, however, schooling first has to be made attractive as a consumption good and then effective as an investment in human capital. Otherwise, this population has no incentive to forego the discretionary income that work produces in favor of more time in school.

In the energy conservation case, the problem was how to tip investment, production, and consumption decisions for various types of consumers in favor of conservation. In the youth employment case, the problem is how to tip the labor force participation, education, and training decisions for various types of young people toward employment prospects that have a high likelihood of success. For the high risk group, solving the employment problem involves reducing the opportunity costs of schooling, so that young people in this group have the same options to pursue education and training as those in the low risk group. For the transitional population, solutions involve making education more attractive as a consumption and investment good, so that young people in this group resolve the trade-off between discretionary income gained from work and time spent in schooling in favor of reduced labor force participation. For the low risk population, solutions involve not increasing the incentives to trade time in school for discretionary income until prospects of employment are relatively high. For the high risk group, unemployment is a serious problem, but it is not necessarily one that can be solved by employment; it is more likely to be solved by decreasing the opportunity costs of education and training. For the transitional and low

risk groups, unemployment may be a positive incentive to reduce labor force participation, but the longer term solution is to make schooling more attractive.

In other words, youth employment is a significantly different policy problem from adult employment. For the youth population the trade-off between work and schooling is the key decision. For the adult population this trade-off is less important, although still present. Consequently, institutional structures play a more immediate role in determining the outcomes of youth employment policy than they do for adults. Young peoples' preferences for work and schooling are shaped to a large degree by how effective schools are in communicating their value to young people. For adults, schooling is an alternative to work but a less important factor in labor market decisions. This means that a significant portion of the youth employment problems lies in the institutional forces that shape young peoples' preference for work over school. This portion of the problem cannot be solved by making jobs available to young people or by making it easier for young people to enter the labor force. In fact, these measures probably aggravate the problem to some degree by making labor market entry easier for the transitional population and by removing pressure from schools to respond to that population.

As in the energy conservation case, the outcomes that one would expect to follow from youth employment policy vary by the target group. For the high risk group, it seems plausible to expect that policy should reduce the opportunity costs of education and training to at least the level of those for the middle income population, so that young people have an equal incentive to pursue schooling as an alternative to work. For the transitional population, it seems plausible to expect that policy should offer no direct incentives to substitute discretionary income for education, and that it should strengthen the appeal of education as both a consumption good and as a long-term

investment. For the low-risk population, it is plausible to expect that policy should offer no direct incentive to substitute discretionary income for education. Nor should policy offer any direct incentive to displace adult workers with young workers from any population.

Moving back one level, to implementing organizations, the full effect of multiple jurisdictions and multiple objectives becomes clear. While it is possible to say, from the national level, what the important target groups are, what the key decisions are, and what plausible outcomes one might expect to follow from national policy, virtually all the capacity for identifying these groups and influencing their decisions resides at the local level. So the implementation problem, from the national level, is how to mobilize the capacity of states and localities in the service of national objectives. This problem is more complex than the single-jurisdiction problem in three respects: First, states and localities have independent authority and different political incentives than the federal government. Hence, they cannot be expected to view the preferred outcomes of employment policy in the same way as the federal government. Second, the parameters affecting employment policy vary substantially from one setting to another, making a reasonable expectation in one setting an unreasonable one in another. Settings that have high rates of cyclical adult unemployment, for example, should not be expected to address youth employment problems with the same level of intensity as those that have lower rates. Third, the institutional capacity within jurisdictions-- schools, training organizations, community colleges, employers, etc.-- varies widely. In the single-jurisdiction case, the problem was how to get an organization to respond to a policy, while at the same time minimizing the effects of the policy on its internal operations. In the multiple-jurisdiction, multiple-objective case, the problem is how to

get lower level jurisdictions to trade one policy objective against another in a way that produces aggregate effects consistent with national policy. Notice that we assume lower-level jurisdictions will trade objectives, rather than assuming that all jurisdictions will treat all national objectives as equally binding. Failing to do so means that we make the conceptual error of treating separate political jurisdictions as if they were extensions of a single jurisdiction.

If we characterize implementation as trading among objectives, then it makes sense to think of the responses of implementing organizations in terms of performance on the outcomes that policymakers regard as important, rather than compliance with specific provisions of national policy. Focusing on compliance, to the exclusion of performance, could result, as noted earlier, in a number of perverse consequences that undermine the overall effect of policy. For youth employment policy, it is especially important that implementing organizations reflect the trade-offs between youth and adult employment and between schooling and work for the youth population in their operating decisions. Decisions that result in young people displacing adult workers, regardless of how effective they are in their own right, don't increase aggregate employment. Decisions that result in more opportunities for young people to trade participation in school for discretionary income, regardless of whether they produce more youth employment, don't necessarily increase the long-term employment prospects for young people. Left to their own devices, separate organizations charged with education, training, job placement, and enforcement of employment standards, will go on producing (or not producing) whatever is required to keep the flow of resources going, regardless of its aggregate consequences. The incentives that make these organizations work in accord with some larger design reside in the political structure at the local, state, and federal level. Successful implementation

of national policy requires that lower level political jurisdictions exercise sufficient authority to make the aggregate consequences of separate implements in separate organizations correspond to national objectives. Hence, it is in the interests of the federal government to use its influence to create stronger lateral control at lower levels, cutting across multiple implements and implementing organizations, and to get lower level governments to commit themselves publicly to aggregate results. But in creating stronger lateral control at lower levels, the federal government gives up a degree of vertical control over compliance with the specific requirements of separate implements.

From the federal level, then, the important strategic decision is how much vertical control to exercise on what subjects and how much lateral control to create at lower levels. The main feature of federal policy toward youth employment, which is clear from Table 2A, is that it is composed almost exclusively of vertical lines of authority, each with a separate organizational base at the state and local level, and very little lateral control. Vocational education policy, addressed primarily to the transitional and low risk populations, creates a vertical structure from the federal to the state and local levels. This structure is distinct not only from the employment security and employment training systems, but it is also structurally distinct from the educational system in which it nominally resides. Employment security policy, which addresses all youth populations through the labor exchange, unemployment compensation, and regulatory systems, follows a different vertical structure from the federal to the state level. Employment training policy, which deals exclusively with the high risk population, follows yet another vertical structure, this one based largely on direct federal-local relations. In this structure, there are virtually no incentives for lateral control at the state or local level, hence, no

incentives to view the outcomes produced by separate structures in relation to each other. Vocational schools and community colleges produce large numbers of people trained in skilled occupations without regard for their effect on the adult labor market. The employment training and employment security systems administer special programs designed to place high risk young people in long-term jobs, but maintain only a marginal relationship to the vocational schools. The employment training system administers a large number of programs designed to provide high school equivalency training to high risk youth, but maintains only a marginal relationship to the educational system. Viewed from the top, or from the forward mapping perspective, this seems to be a plausible portfolio of implements and organizations. Viewed from the bottom, or backward mapping perspective, the system as a whole appears to be less than the sum of its parts. There are few mechanisms at any level of the system to make explicit trade-offs among competing objectives or to make organizations with different missions orchestrate their decisions around a common set of outcomes. Hence, there is no way to judge, from the federal level, whether the aggregate effect of federal policy bears any relationship to what policymakers would like to achieve.

One way for the federal government to address this problem of lateral control is to introduce incentives for states and localities to make trade-offs among key objectives explicit, public, and politically binding. Some portion of federal grants for vocational education could be conditioned on meeting locally-defined occupational targets, justified in terms of local labor market demands, the output of competing programs, and entry level skill requirements. Work experience and summer employment programs for high risk youth could be conditioned on contracts between the school system and the young person to maintain some level of academic progress, and on contracts between employment training system and the vocational education system to move

a certain number of high risk youth into vocational programs. Incentives to employers to hire high risk youth could be predicated on a three-way contract between the schools, the employer, and the young person, tying the subsidy to some level of academic performance. In each case, the expected effect of these implements is to get one part of a complex delivery system to acknowledge explicitly its relationship to other parts, and to make that relationship work for some individual. These may not be the best implements, but they illustrate how one level of government can use conditional grants and subsidies to generate incentives for lateral control within another level.

Reversible Logic: Reprise

The difference between the simple and the complex case, then, is the introduction of multiple jurisdictions and trading among multiple objectives. On the forward leg, implements translate into distinct organizational paths extending across jurisdictional boundaries, producing outcomes at some level. But there is nothing in this analytic view to suggest how these various implements produce aggregate effects, or what policymakers can do to influence those effects. In order to address this question, we had to turn the system around and ask, first, what decisions policy must influence in order to have any effect, second, what the stakes of those decisions are for various target groups, third, how policy affects those decisions, fourth, which jurisdictional level has the closest proximity to those decisions, and finally, how policymakers can maneuver political jurisdictions into making explicit trade-offs among objectives to produce results that are, at once, consistent with national objectives and with variable local conditions.

From the forward mapping perspective, the problem is finding a collection of implements that is likely to produce the effect that policymakers want. From the backward mapping perspective, the problem is finding a set of

decisions that policy can influence and specifying how policy can tip those decisions in the desired direction. Forward mapping stresses what policymakers control; backward mapping stresses the marginal influence that policy exercises over decisions by individuals and organizations. If we were to look at policy decisions only from the forward mapping perspective, we would consistently overestimate the degree of control policymakers exercise. Policymakers tend to see the world through the lens of the implements they control; they solve problems by applying parochial solutions. But the success of policy depends on more than choosing the correct combination of implements; it depends as well on conditions outside the control of policymakers and on decisions over which policy exercises only a marginal influence. In order to be good strategists, policymakers have to calculate the consequences of their actions from the point of view of the decisions they are trying to influence. This is the perspective of backward mapping.

## FOOTNOTES

[1]Edith Stokey and Richard Zeckhauser, A Primer for Policy Analysis (New York: Norton, 1978), 211ff.

[2]James Trefil, "Closing in on Creation," Smithsonian Magazine, May 1983, 33-51.

[3]This is equivalent to the property of symmetry in mathematics, in which if a+b=c+d, then c+d=a+b. In the language of policy analysis, reversible relationships might be characterized as follows: If some policy implement 'x' is thought to produce outcome 'y', then one ought to be able to begin with 'y' and reconstruct the process by which 'x' produces it.

[4]"...people pursue their self-interests not only within given rules but also by investing resources to change the rules to their own benefit." Giandomenico Majone, "Choice Among Policy Instruments for Pollution Control," Policy Analysis, Vol. 2, no. 4 (1976), 590.

[5]For example,

> As usually presented, analysis (no matter what the approach or technique) appears to be linearly deductive rather than dynamically iterative. The analytical tool is introduced as a recipe-- clear, sequential, mechanical-- with the assumptions necessary to use the tool provided in a convenient, checklist form.... But the concepts need to be applied simultaneously and iteratively...

Robert Behn, Quick Analysis for Busy Decisionmakers (New York: Basic Books, 1982), 56.

[6]Richard Elmore, "Backward Mapping: Implementation Research and Policy Decisions," Political Science Quarterly, Vol. 94, no. 4 (Winter 1979-80), 601-616.

[7]Alan Rosenthal suggests that, for legislators, individual incentives work against attention to implementation, because legislators must maximize credit in the short term, deliver concrete results, and avoid becoming embroiled in complexities they can't resolve. But the institutional incentives of legislatures relative to other parts of government work in favor of attention to implementation. Hence, he finds, legislatures dedicate more time and energy to oversight of administration than one would predict solely on the basis of the incentives under which individual members work. Alan Rosenthal, "Legislative Behavior and Legislative Oversight," Legislative Studies Quarterly, Vol. 6, no. 1 (February 1981), 115-131.

[8]This line of reasoning summarizes an earlier chapter entitled, "Policy Analysis as the Choice of Implements."

[9]Thomas Schelling, The Strategy of Conflict, (New York and London: Oxford University Press, 1960), 84.

[10]I use the term "parameter" consistently with one of its meanings, which is a constant in a particular calculation that can be varied in other calculations. The term can also be used to mean any measureable factor that helps to define a system of relationships. The former meaning helps to distinguish in policy aalysis between those factors considered "constant" for purposes of a particular analysis, but not necessarily immune to influence by policy.

[11]Michael Lipsky, Street-Level Bureaucracy (New York: Russell Sage, 1980).

[12]Stephen Rosenthal, Managing Government Operations (Glenview, Ill: Scott, Foresman, 1982), Chapter 11, "Case Management and Policy Implementation," 210-232.

[13]This section draws extensively on another paper entitled, "Youth Employment: Defining the Policy Problem."

[14] Richard Freeman and David Wise, "The Youth Labor Market Problem: Its Nature, Causes, and Consequences," in Freeman and Wise, eds., The Youth Labor Market Problem (Chicago: University of Chicago Press, 1978), 1-16; Martin Feldstein and David Ellwood, "Teenage Unemployment: What is the Problem?" ibid., 17-33.

[15]Labor force participation for 18-19 year-old minority males, for example, declined from 71.2% in 1960 to 57.8% in 1979. The relationship holds for all minority males in the 16-24 age bracket. Handbook of Labor Statistics, U.S. Department of Labor, 1980, Table 4.

[16]One study based on 1975 data estimates, for example, that "since nonwhites are a relatively small fraction of the teenage population,... lowering the unemployment rate of the nonwhite group to [that of] the white group...would only lower the unemployment rate for all out-of-school male teenagers from 19% to 16%." Feldstein and Ellwood, op. cit., 26.